

## 0.a. Goal

Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

## 0.b. Target

Target 2.c: Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility

## 0.c. Indicator

Indicator 2.c.1: Indicator of food price anomalies

## 0.e. Metadata update

March 2021

## 0.f. Related indicators

Not applicable

## 0.g. International organisations(s) responsible for global monitoring

Food and Agriculture Organization of the United Nations (FAO)

## 1.a. Organisation

Food and Agriculture Organization of the United Nations (FAO)

## 2.a. Definition and concepts

### Definition:

The indicator of food price anomalies (IFPA) identifies market prices that are abnormally high. The IFPA relies on a weighted compound growth rate that accounts for both within year and across year price growth. The indicator directly evaluates growth in prices over a particular month over many years, taking into account seasonality in agricultural markets and inflation, allowing to answer the question of whether or not a change in price is abnormal for any particular period.

### Concepts:

The indicator of price anomalies (IFPA) relies on two compound growth rates (CGR's), a quarterly compound growth rate (CQGR) and an annual compound growth rate (CAGR). A CGR is a geometric mean<sup>[1]</sup> that assumes that a random variable grows at a steady rate, compounded over a specific period of time. Because it assumes a steady rate of growth the CGR smoothes the effect of volatility of price changes. The CGR is the growth in any random variable from time period  $t_A$  to  $t_B$ , raised to the power of one over the length of the period of time being considered

$$CXGR_t = \left( \frac{P_{t_B}}{P_{t_A}} \right)^{\frac{1}{t_B - t_A}} - 1 \quad (1)$$

Where:

$CXGR_t$  is the quarterly or annual compound growth rate in month  $t$

$P_{t_A}$  is the price at the beginning of the period

$P_{t_B}$  is the price at the end of the period,

$t_B - t_A$  is the time in months between periods  $A$  and  $B$ .

The quarterly ( $QIFPA_{yt}$ ) and annual ( $AIFPA_{yt}$ ) indicators of food price anomalies are then defined as:

$$\left( \frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}} \right) = XIFPA_{yt} \quad (2)$$

Where:

$CXGR_{yt}$  is either the quarterly or annual compound growth rate in month  $t$  for year  $y$

$\overline{W\_CXGR_t}$  is the weighted average of either the quarterly or annual compound growth rate for month  $t$  across years  $y$

$\hat{\sigma}_{W\_CXGR_t}$  is the weighted standard deviation of either the quarterly or annual compound growth rate for month  $t$  over years  $y$ ,

$XIFPA_{yt}$  is either the quarterly or annual indicator of a price anomaly.

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<sup>1</sup> A geometric mean is a type of average, which indicates the typical value of a set of numbers by using the product of their values as opposed to the arithmetic mean which relies on their sum ([Wikipedia, 2017](#)) <sup>1</sup>

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## 2.b. Unit of measure

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Not applicable as IFPA is an index.

## 2.c. Classifications

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Not applicable

### 3.a. Data sources

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FAO relies on official domestic price data that it compiles in the Food Price Monitoring and Analysis ([FPMA](#)) tool to calculate and monitor the indicator. Five cereal products will be monitored: maize & maize products, wheat & wheat flour, rice, sorghum and millet. While diets across the world have become more diversified with increasing incomes, cereals still account for 45 percent of a person's daily caloric intake, making this commodity group the most important in terms of its contribution to caloric intake, particularly for low income populations (FAOSTAT, 2017). For the purpose of a more comprehensive coverage at the global level, FAO also calculates IFPA on countries' officially reported food price indices as reported in [FAOSTAT](#), which facilitates cross country comparisons as it uses a national level food basket covering all the most important commodities consumed. While the basket differs from country to country, this approach is more reflective of national and global trends as countries have predefined the commodities that have the most impact on local consumers. This approach also facilitates the implementation of the indicator as countries will not be asked to create a new index or modify existing methodologies.

For the Food CPI, the FAOSTAT monthly CPI & Food CPI database was based on the ILO CPI data until December 2014. In 2014, IMF-ILO-FAO agreed to transfer global CPI data compilation from ILO to IMF. Upon agreement, CPIs for all items and its sub components originates from the International Monetary Fund (IMF), and the UN Statistics Division (UNSD) for countries not covered by the IMF. However, due to a limited time coverage from IMF and UNSD for a number of countries, the Organisation for Economic Co-operation and Development (OECD), the European statistics (EUROSTAT), the Latin America and the Caribbean statistics (CEPALSTAT), Central Bank of Western African States (BCEAO), Eastern Caribbean Central Bank (ECCB) and national statistical office website data are used for missing historical data from IMF and UNSD food CPI. The FAO CPI dataset for all items (or general CPI) and the Food CPI, consists of a complete and consistent set of time series from January 2000 onwards. It further contains regional and global food CPIs compiled by FAO using population weights to aggregate across countries.

### 3.b. Data collection method

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Food commodity prices are collected from webpages, newsletters or emails from national agencies responsible for collecting and disseminating food prices. Food Price Indices are collected from [FAOSTAT](#) (please refer to the 3.a. Data sources).

### 3.c. Data collection calendar

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Food commodity prices in the [FPMA](#) tool are updated monthly. Food Price Indices in [FAOSTAT](#) are updated quarterly

### 3.d. Data release calendar

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The next release for data on this indicator is projected for

### 3.e. Data providers

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The sources of the price information are numerous and are listed for each price series in the FPMA tool at <https://fpma.apps.fao.org/gIEWS/food-prices/tool/public/#/home>.

For the Food Price Indices the source is FAOSTAT <http://www.fao.org/faostat/en/#data/CP>

### 3.f. Data compilers

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FAO

### 3.g. Institutional mandate

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Article I of the FAO constitution requires that the Organization collect, analyses, interpret and disseminate information relating to nutrition, food and agriculture  
<http://www.fao.org/3/K8024E/K8024E.pdf>.

## 4.a. Rationale

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The thresholds for the  $IFPA_y$  are expressed as the normalized difference of the compound growth rate of prices from their historical mean for the predefined period of time. And three ranges are established: 1) a less than half a standard deviation difference from the mean is considered normal; 2) a difference that is half but less than one standard deviation is considered moderately high; 3) a difference from the historical mean that is at least one standard deviation greater than the mean is considered abnormally high.

$$0.5 \leq IFPA_y < 1 \quad \text{Moderately High}$$

$$IFPA_y \geq 1 \quad \text{Abnormally High}$$

$$-0.5 \leq IFPA_y < 0.5 \quad \text{Normal}$$

We use one standard deviation as the relevant threshold since we want to minimize the probability of missing a significant market event. Events that deviate by more than one standard deviation from their historical distribution have a low probability of occurring and thus are easier to identify as abnormally high prices.

## 4.b. Comment and limitations

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It is appropriate to caution the reader that the indicator is just a guide to understanding market dynamics. As such, one cannot rely on it as the sole element to determine whether a food price in a particular market at a given time is abnormally high or low due to the direct effects of local policies. Results must be weighed with other available information on market fundamentals, macroeconomic context and external shocks. The main challenge in implementing the indicator is data availability and data quality. The calculation of the indicator requires an uninterrupted monthly price series (i.e. if more than 3 consecutive months of data are missing the series may be dropped) of at least 5 years, which include the year being analysed and the 4 preceding years to generate averages and standard deviations. Finally, the indicator is calculated on real price terms to net out the effects of inflation and compare prices in constant money terms over time. However, if food items' contribution to CPI is high, it induces downward bias in food real price – i.e., it underestimates the extent of the price increase (nominal prices or a non-food CPI could be used).

## 4.c. Method of computation

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Mathematically the IFPA for a particular year  $y$  in month  $t$  is calculated as the weighted sum of the quarterly indicator of food price anomalies ( $QIFPA_{yt}$ ), and the annual indicator of food price anomalies ( $AIFPA_{yt}$ ) as stated in equation 1.

$$IFPA_{yt} = \gamma QIFPA_{yt} + (1 - \gamma) AIFPA_{yt} \quad (3)$$

Where:

$IFPA_{yt}$  is the indicator of food price anomalies in year  $y$  and month  $t$

$QIFPA_{yt}$  is the quarterly indicator of food price anomalies in year  $y$  and month  $t$

$AIFPA_{yt}$  is the annual indicator of food price anomalies in year  $y$  and month  $t$

$\gamma$  is a weight with a value of 0.4.

The weight  $\gamma$  establishes the relative importance of quarterly ( $QIFPA_t$ ) anomalies to the year-on-year price variations ( $AIFPA_{yt}$ ). The weight  $\gamma$  is set to 0.4, giving a weight of 0.6--( $1 - \gamma$ )-- to abnormal price growth from year-to-year. This is done to better capture the price level relative to its seasonal trends, which is measured to the price level a year earlier. SDG indicator 2.c.1 is then calculated as the arithmetic mean over  $t$  months of the

$IFPA_{yt}$  as follows:

$$IFPA_y = \frac{1}{t} \sum_{i=1}^t IFPA_{yt} \quad (4)$$

Where:

$IFPA_y$  is the annual indicator of food price anomalies in year  $y$

$IFPA_{yt}$  is the indicator of food price anomalies in year  $y$  and month  $t$

$t$  is the number of months in a year

## 4.d. Validation

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Not applicable

## 4.e. Adjustments

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Not applicable

## 4.f. Treatment of missing values (i) at country level and (ii) at regional level

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- At country level

For the domestic food commodity prices, the data is republished data harvested from national governmental organizations without imputation of missing values. For the purpose of the indicator, if more than 3 consecutive months of data are missing or if less than 5 years are available the series may be dropped from monitoring.

For the food price index in [FAOSTAT](#), the data is republished data harvested from other international organizations without imputation of missing values. For the purpose of the indicator, if more than 3 consecutive months of data are missing or if less than 5 years are available the series may be dropped from monitoring.

- At regional and global levels

Not Applicable

## 4.g. Regional aggregations

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**Consumer Food Price Index:** Results are organized on a regional basis but IFPA values are not aggregated as such. The unit of the indicator provided for each region represents instead the proportion of countries recording abnormally high or moderately high food prices in each region.

**Five key commodities (maize, rice, wheat, sorghum, millet):** Results are not organized on a regional basis but at country level. This is because the commodities and food baskets monitored across countries are not sufficiently homogenous to aggregate into one price index. However, if a majority of countries within a region presents abnormally high prices, either for a particular commodity or the food price index, this region is qualified as a region suffering from high prices.

### Sources of discrepancies:

FAO relies on the Food Price Indices as reported in FAOSTAT as well as on available official domestic food price data that it compiles in the Food Price Monitoring and Analysis (FPMA) tool to calculate the indicator. The FPMA database brings together price series for main food commodities (mainly cereal products) in selected markets in countries around the world. As a result, the indicator estimated by FAO can differ from the indicator estimated at country level, as it may be calculated on prices for a different market or commodity.

## 4.h. Methods and guidance available to countries for the compilation of the data at the national level

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An interactive e-learning course is available on [SDG Indicator 2.c.1 – Food price anomalies](#) to complement countries' efforts in monitoring the 2030 Agenda and broaden the subject's understanding. The course covers basic concepts related to market functioning, prices determination and price volatility and explains how to calculate the indicator and use the online Food Price Monitoring and Analysis (FPMA) tool to interpret indicator results, at national and international level. Besides in English, the online version of this course is also available in [Russian](#), French and Spanish.

## 4.i. Quality management

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FAO is responsible for the quality of the internal statistical processes used to compile the published datasets. The FAO Statistics Quality Assurance Framework (SQA), available at:

<http://www.fao.org/docrep/019/i3664e/i3664e.pdf>, provides the necessary principles, guidelines and tools to carry out quality assessments. FAO is performing an internal bi-annual survey (FAO Quality Assessment and Planning Survey) designed to gather information on all of FAO's statistical activities, notably to assess the extent to which quality standards are being implemented with a view to increasing compliance with the quality dimensions of SQAF, documenting best practices and prepare quality improvement plans, where necessary. Domain-specific quality assurance activities are carried out systematically (e.g. quality reviews, self-assessments, compliance monitoring).

## 4.j. Quality assurance

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- The indicator is calculated on food price data, which is gathered from official sources, same as for the food price index published in FAOSTAT. To ensure the correct calculation of the indicator, the process for the calculation of the indicator relies on an automated system.
- On request, countries are supported by FAO to implement the indicator and interpret the results. In addition, training is provided in the country upon request.

## 4.k. Quality assessment

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The responsible officer conducts a self-assessment of the calculation process and its outputs on the basis of the FAO Statistics Quality Assurance Framework (SQAF). The SQAF considers the following principles: relevance, accuracy and reliability, timelessness and punctuality, coherence and comparability, and accessibility and clarity.

## 5. Data availability and disaggregation

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### Data availability:

Breakdown of the number of countries covered by region, according to the latest data, is as follows:

| Region             | Food prices | Food CPI |
|--------------------|-------------|----------|
| World              | 77          | 187      |
| Africa             | 30          | 49       |
| Northern Africa    | 2           | 5        |
| Sub-Saharan Africa | 28          | 44       |
| Eastern Africa     | 11          | 16       |

|                                 |    |    |
|---------------------------------|----|----|
|                                 |    |    |
| Middle Africa                   | 2  | 7  |
| Southern Africa                 | 4  | 5  |
| Western Africa                  | 11 | 16 |
| Americas                        | 18 | 40 |
| Latin America and the Caribbean | 18 | 37 |
| Caribbean                       | 2  | 18 |
| South America                   | 9  | 11 |
| Central America                 | 7  | 8  |
| Northern America                |    | 3  |
| Asia                            | 24 | 44 |
| Central Asia                    | 3  | 3  |
| Eastern Asia                    | 3  | 4  |
| Southern Asia                   | 5  | 9  |
| South-Eastern Asia              | 6  | 11 |



|                           |   |    |
|---------------------------|---|----|
| Western Asia              | 7 | 17 |
| Europe                    | 5 | 41 |
| Eastern Europe            | 3 | 10 |
| Northern Europe           |   | 11 |
| Southern Europe           | 1 | 13 |
| Western Europe            |   | 7  |
| Oceania                   |   | 13 |
| Australia and New Zealand |   | 2  |
| Melanesia                 |   | 5  |
| Micronesia                |   | 3  |
| Polynesia                 |   | 3  |

**Time series:**

While IFPA on commodity prices is available from 2015 to 2020, IFPA on Food CPI covers the range of the 2010-2019 period, following the availability of CPI data in FAO STAT as of mid-January, 2021.

**Disaggregation:**

Type of product, level of price anomaly

## 6. Comparability/deviation from international standards

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FAO relies on the Food Price Indices as reported in FAOSTAT as well as on available official domestic food price data that it compiles in the Food Price Monitoring and Analysis (FPMA) tool to calculate the indicator. The FPMA database brings together price series for main food commodities (mainly cereal products) in selected markets in countries around the world. As a result, the indicator estimated by FAO can differ from the indicator estimated at country level, as it may be calculated on prices for a different market or commodity. When food products that are most relevant to the country differ from the five commodities that FAO calculates, countries are strongly encouraged to produce the IFPA of those food items and monitor their price volatilities.

## 7. References and Documentation

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### URL:

<http://www.fao.org/giews/food-prices/research/en/>

### References:

<https://fpma.apps.fao.org/giews/food-prices/tool/public/#/home>